CLAIMS

1. A method for treating malfunctioning cells in a living mammal, which comprises:

(a) administering a compound which associates with DNA in cells of said mammal, said compound comprising a pre-selected element; and then

(b) irradiating a selected region, in which malfunctioning cells having said compound associated with DNA are located, with line emission x-rays of an energy selected to cause emission of Auger electrons from said pre-selected element of said compound in a dose effective to disrupt DNA proximate to the irradiated pre-selected element.

2. A method according to claim1, wherein the compound intercalates into the DNA helix.

3. A method according to claim 1, wherein the compound binds to the DNA.

4. A method according to claim 1, wherein the compound is substantially non-toxic.

5. A method according to claim 1, wherein the compound has an affinity for both normal and malfunctioning cells.

6. A method according to claim 5, wherein the compound is substantially non-toxic.

7. A method according to claim 1, wherein the compound has a selective affinity for malfunctioning cells.

8. A method according to claim 1, wherein the compound is selected from the group consisting of annamycin, bromodeoxyuridine, bromodeoxycytosine and iododeoxyuridine

9. A method according to claim 1, wherein the compound is

iododeoxyuridine.

10. A method according to claim 9, wherein the compound is bromodeoxyuridine.

11. A method according to claim 1, wherein the compound is a ruthenium compound which binds to or intercalates into DNA.

12. A method according to claim 1, wherein the compound is cisplatin.

13. A method according to claim 1, wherein the pre-selected element of the compound has an atomic number in the range of from 35 to 79.

14. A method according to claim 13, wherein the pre-selected element of the compound is selected from the group consisting of Ru, I and Gd.

15. A method according to claim 13, wherein the malfunctioning cells of the mammal's body are superficial and the pre-selected element of the compound is Br.

16. A method according to claim1, wherein the compound is selected to have a high rate of excretion by normal physiological processes.

17. A method according to claim 1, wherein the compound is selected for stability against dissociation of the pre-selected element during the time prior to substantially complete excretion or metabolism of the compound.

18. A method according to claim 1, wherein an end window transmission x-ray tube producing bright line emission x-rays is used for irradiating.

19. A method according to claim 18, wherein an e-beam generated in the x-ray tube is focused on a thin target having a thickness of up to about 40 μm, said target being inside the tube and functions as part of the end window.

20. A method according to claim 19, wherein the target and the e-beam energy are selected to provide substantially monochromatic line emission x-rays having an energy above and near the K-absorption edge of the pre-selected element of the compound.

21. A method according to claim 20, wherein the thin target is selected

from the group consisting of Mo, Ag, La, Sr and Tm.

22. A method according to claim 19, wherein the target and the e-beam energy are selected to provide substantially monochromatic line emission x-rays having an energy above and near the L-absorption edge of the pre-selected element of the compound.

23. A method according to claim 22, wherein the thin target is Rb.

24. A method according to claim 23, wherein the pre-selected element of the compound is Pt.

25. A method according to claim 1, wherein Auger electrons are released with a dose of at least about 10^6 Gy.

26. A method according to claim 25, wherein the dose of at least about 10^6 Gy is released within a distance from the element of the compound of up to about 10 angstroms.

27. A method according to claim 1, wherein step (b) is repeated at least once.

28. A method according to claim 27, wherein Auger electrons are released during each repetition of step(b) with a dose of at least about 10^6Gy.

29. A method according to claim 28, wherein the dose of at least about 10^6 Gy is released within a distance from the element of the compound of up to about 10 angstroms.

30. A method according to claim 1, wherein step (b) is performed on cells removed from the mammal.

31. A method according to claim 30, wherein after step (b) is performed, the removed cells are returned to the mammal.

32. A method according to claim 30, wherein after step (b) is performed, the removed cells are transplanted.

33. A method according to claim 1, wherein step (a) and step (b) are performed on cells removed from the mammal.

34. A method according to claim 33, wherein after step (b) is performed, the removed cells are returned to the mammal.

35. A method according to claim 33, wherein after step (b) is performed, the removed cells are transplanted.

36. A method of treating tumors or cancer in a human in need of such treatment, which comprises:

(a) administering to the human a compound which associates with DNA in cells of said human, said compound comprising a pre-selected element; and then

(b) irradiating a selected region, in which cancerous cells having said compound associated with DNA are located, with line emission x-rays of an energy selected to cause emission of Auger electrons from said pre-selected element of said compound in a dose effective to disrupt DNA proximate to the pre-selected element.

37. A method according to claim 36, wherein the compound intercalates into the DNA helix.

38. A method according to claim 36, wherein the compound binds to the DNA.

39. A method according to claim 36, wherein the compound is substantially non-toxic.

40. A method according to claim 36, wherein the compound has an affinity for both normal and cancerous cells.

41. A method according to claim 40, wherein the compound is substantially non-toxic.

42. A method according to claim 36, wherein the compound has a selective affinity for cancerous cells.

43. A method according to claim 36, wherein the compound is selected

from the group consisting of annamycin, bromodeoxyuridine, bromodeoxycytosine and iododeoxyuridine.

44. A method according to claim 36, wherein the compound is iododeoxyuridine.

45. A method according to claim 36, wherein the compound bromodeoxyuridine.

46. A method according to claim 36, wherein the compound is a ruthenium compound which binds to or intercalates into DNA.

47. A method according to claim 36, wherein the compound is Cisplatin.

48. A method according to claim 36, wherein the pre-selected element of the compound has an atomic number in the range of from 35 to 79.

49. A method according to claim 48, wherein the pre-selected element of the compound is selected from the group consisting of Ru, I and Gd.

50. A method according to claim 48, wherein the cancerous cells of the human's body are superficial and the pre-selected element of the compound is Br.

51. A method according to claim 36, wherein the compound is selected to have a high rate of excretion by normal physiological processes.

52. A method according to claim 36, wherein the compound is selected for stability against dissociation of the pre-selected element during the time prior to substantially complete excretion or metabolism of the compound.

53. A method according to claim 36, wherein an end window transmission x-ray tube producing bright line emission x-rays is used for irradiating.

54. A method according to claim 53, wherein an e-beam generated in the x-ray tube is focused on a thin target having a thickness of up to about 40 μm, said target being inside the tube and functions as part of the end window.

55. A method according to claim 54, wherein the target and the e-beam energy are selected to provide substantially monochromatic line emission x-rays having an energy above and near the K-absorption edge of the element of the

compound.

56. A method according to claim 55, wherein the thin target is selected from the group consisting of Mo, Ag, La, Sr and Tm.

57. A method according to claim 54, wherein the target and the e-beam energy are selected to provide substantially monochromatic line emission x-rays having an energy above and near the L-absorption edge of the pre-selected element of the compound.

58. A method according to claim 57, wherein the thin target is Rb.

59. A method according to claim 58, wherein the pre-selected element of the compound is Pt.

60. A method according to claim 36, wherein Auger electrons are released with a dose of at least about 10^6 Gy.

61. A method according to claim 60, wherein the dose of at least about 10^6 Gy is released within a distance from the element of the compound of up to about 10 angstroms.

62. A method according to claim 36, wherein step (b) is repeated at least once.

63. A method according to claim 62, wherein Auger electrons are released during each repetition of step (b) with a dose of at least about 10^6 Gy.

64. A method according to claim 63, wherein the dose of at least about 10^6 Gy is released within a distance from the element of the compound of up to about 10 angstroms.

65. A method of treating cancer in a human in need of such treatment, which comprises:

(a) administering to the human a compound which associates with DNA, in cells of said human, said compound comprising a pre-selected element selected from the group consisting of Br, Ru, I, Gd and Pt; and then

(b) irradiating at least once, by means of an end window transmission x-ray tube, a selected region, in which cancerous cells having said compound associated with DNA are located, with line emission x-rays of an energy selected to cause emission of Auger electrons from said pre-selected element of said compound in a dose effective to disrupt DNA proximate to the irradiated pre-selected element, said dose for each activation of said x-ray tube being at least about 10^6 Gy within a distance from the pre-selected element of the compound of up to about 10 angstroms.

66. A method according to claim 65, wherein the compound intercalates into the DNA helix.

67. A method according to claim 65, wherein the compound binds to the DNA.

68. A method according to claim 65, wherein the compound is substantially non-toxic.

69. A method according to claim 65, wherein the compound has an affinity for both normal and tumorous cells.

70. A method according to claim 69, wherein the compound is substantially non-toxic.

71. A method according to claim 65, wherein the compound has a selective affinity for tumorous cells.

72. A method according to claim 65, wherein the compound is selected from the group consisting of annamycin, bromodeoxyuridine, bromodeoxycytosine and iododeoxyuridine.

73. A method according to claim 65, wherein the compound is iododeoxyuridine.

74. A method according to claim 65, wherein the compound is

bromodeoxyuridine.

75. A method according to claim 65, wherein the compound is a ruthenium compound which binds to or intercalates into DNA.

76. A method according to claim 65, wherein the compound is cisplatin.

77. A method according to claim 65, wherein the compound is selected to have a high rate of excretion by normal physiological processes.

78. A method according to claim 65, wherein the compound is selected from stability against dissociation of the pre-selected element time prior to substantially complete excretion or metabolism of the compound.

79. A method according to claim 65, wherein an e-beam generated in the x-ray tube is focused on a thin target having a thickness of up to about 40 μm, said target being inside the tube and functions as part of the end window.

80. A method according to claim 79, wherein the target and the e-beam energy are selected to provide substantially monochromatic line emission x-rays having an energy above and near the K-absorption edge of the pre-selected element of the compound.

81. A method according to claim 80, wherein the thin target is selected from the group consisting of Sr, Ag, La, and Tm.

82. A method according to claim 79, wherein the target and the e-beam energy are selected to provide substantially monochromatic line emission x-rays having an energy above and near the L-absorption edge of the pre-selected element of the compound.

83. A method according to claim 82, wherein the thin target is Rb.

84. A method according to claim 83, wherein the pre-selected element of the compound is Pt.

85. A kit for treating malfunctioning cells in a living mammal, which comprises:

(1) an x-ray tube having a target comprising a selected metal, said

tube being capable of emitting monochromatic line emission x-rays; and

(2) a compound comprising a selected element, said compound being capable, upon administration to said mammal, of associating with DNA in cells of said mammal;

the selected metal of said target and the selected element of said compound being selected together: (a) for said metal of said target to emit line emission x-rays having an energy above and near the K-absorption edge or the L-absorption edge of the selected element of said compound, and (b) for said element of said compound to release a dose of Auger electrons upon irradiation by said line emission x-rays.

86. A kit according to claim 85, wherein said x-ray tube is an end window transmission x-ray tube capable of emitting bright, line emission x-rays, said x-ray tube comprising an evacuated, elongated chamber having first and second ends, the first end being connected to a power supply, and within said chamber:

electron emitter means near the first end for generating a beam of electrons;

an end window transparent to x-rays at the second end, an inner portion of said end window comprising said target; and

means for focusing said electron beam on said target.

87. A kit according to claim 86, wherein the target has a thickness of up to about 40μm.

88. A kit according to claim 85, wherein the target is selected from the group consisting of Rb, Mo, Ag, La, Sr and Tm.

89. A kit according to claim 85, wherein the compound is substantially non-toxic.

90. A kit according to claim 85, wherein the compound has an affinity for both normal and malfunctioning cells.

91. A kit according to claim 90, wherein the compound is substantially non-toxic.

92. A kit according to claim 85, wherein the compound has a selective affinity for malfunctioning cells.

93. A kit according to claim 85, wherein the compound is selected from the group consisting of annamycin, bromodeoxyuridine, bromodeoxycytosine and iododeoxyuridine.

94. A kit according to claim 85, wherein the compound is iododeoxyuridine.

95. A kit according to claim 85, wherein the compound is bromodeoxyuridine.

96. A kit according to claim 85, wherein the compound is a ruthenium compound which binds to or intercalates into DNA.

97. A kit according to claim 85, wherein the compound is cisplatin.

98. A kit according to claim 85, wherein the pre-selected element of the compound has an atomic number in the range of from 35 to 83.

99. A kit according to claim 98, wherein the pre-selected element of the compound is selected from the group consisting of Br, Ru, I, Gd and Pt.